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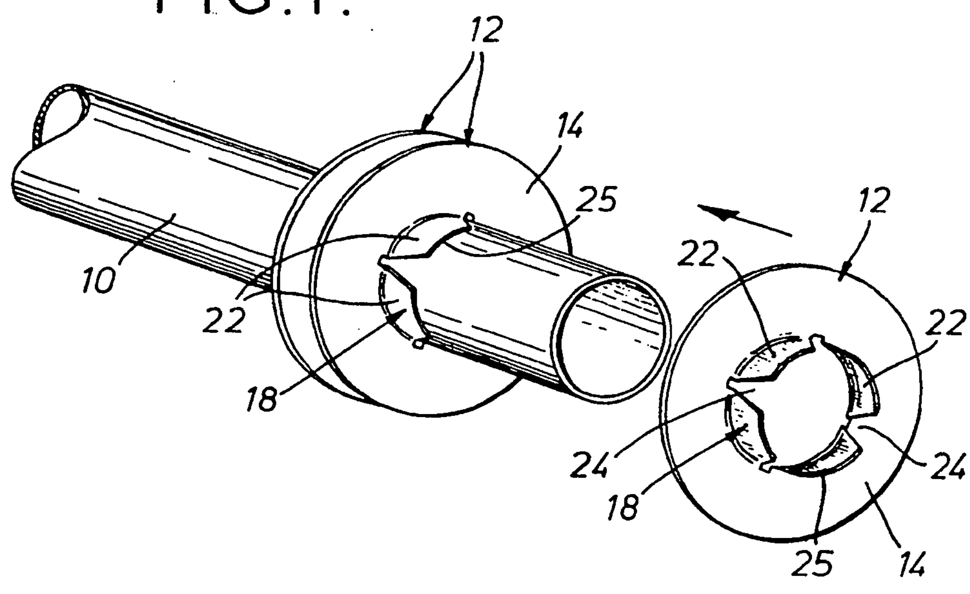
(54) Finned tube heat exchanger members

(57) A heat exchanger finned tube member has a main tube element 10 and a plurality of individual fin elements 12 assembled in juxtaposed relationship along the length of element 10. The elements 12 have a short, tapered axial sleeve 18 which is a push fit on the element 10. The trailing end of each sleeve 18 enters within the mouth of the next adjacent element 12. Tongue-like segments 22 of the trailing end tend to be flattened and forced radially inwardly to firmly grip the tube 10.

FIG.1.



The drawing(s) originally filed was/were informal and the print here reproduced is taken from a later filed formal copy.

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FIG.1.

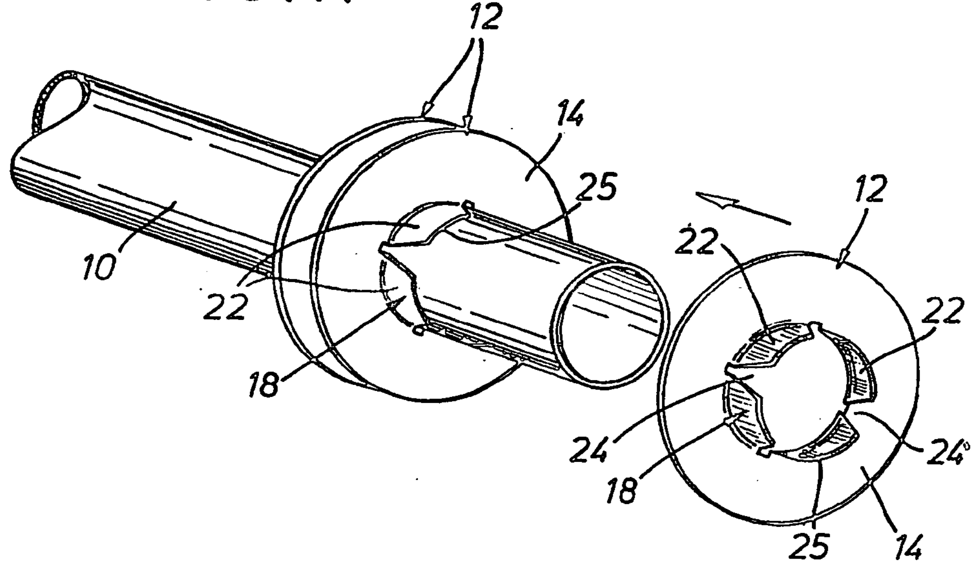


FIG.2.

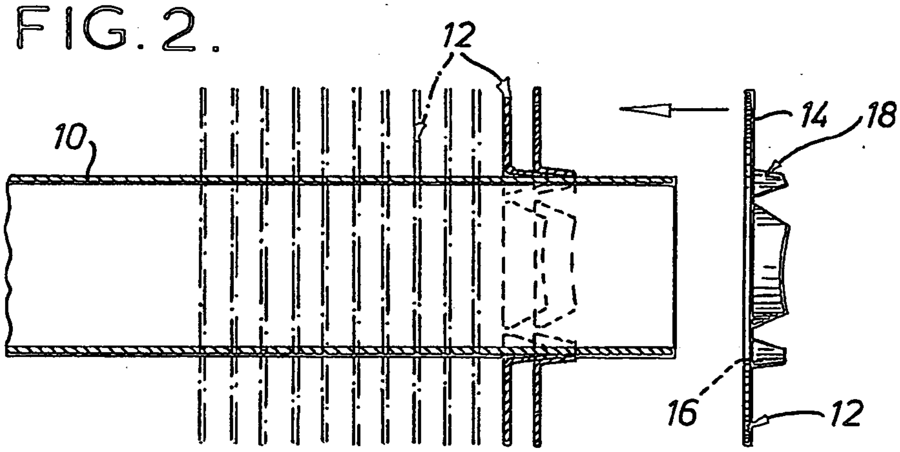


FIG.3.

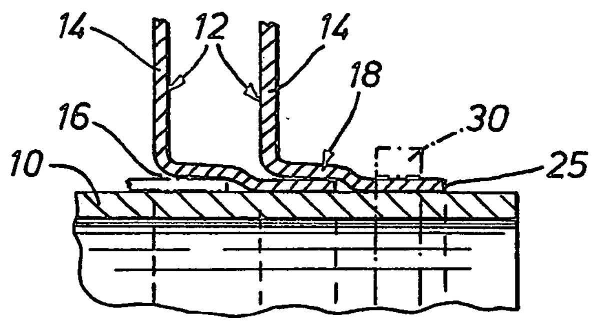
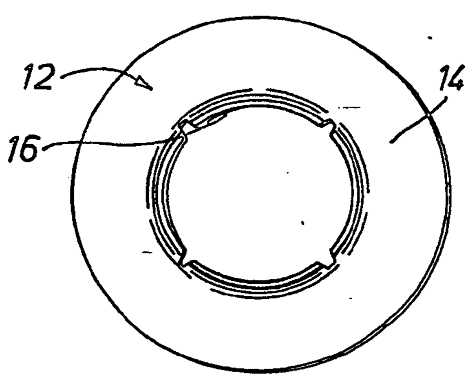


FIG.4.



SPECIFICATION

Finned tube heat exchanger members

This invention relates to finned tube heat exchanger members.

There are many different forms and methods of manufacture of finned tube members used in making radiators and other heat exchangers. In some constructional arrangements fins are formed integrally with the tube element, and in other constructional arrangements separate fin elements are assembled and fitted upon the tube element.

The present invention is concerned more particularly with constructional arrangements of the latter kind, and an object is to provide an improved simple but effective construction which can be manufactured at low cost.

In such constructional arrangements wherein separate fin elements are assembled and fitted upon the tube element, it is known to provide the fin elements in the form of metal plates having plain central apertures very slightly larger than the diameter of the tube element so that such plates can be threaded on to the tube element and can be fixed in position thereon in regularly spaced relationship with the aid of spacers. Such spacers may be provided by bent over integral portions of the plates themselves, and in some cases the separate fin elements are brazed or soldered to the tube element.

According to the present invention, however, the separate fin elements are in the form of push-on sheet-metal fittings each having a plate portion providing the fin and an integral axially-extending sleeve portion which receives and embraces the tube element and engages the latter with close thermal contact to exert a resilient gripping or clamping force that frictionally holds said fin elements in position, said sleeve portion also providing a spacing means for locating the next adjacent fin element.

In preferred embodiments, the sleeve portions of the fin elements have a slightly tapering profile so that when assembled on the tube element adjacent fin elements nest together with the trailing end of the sleeve portion of one element engaging and projecting into the open mouth at the leading end of the sleeve portion of the next element. Thereby, under an axial compressive force applied at the end of the assembly operation, the sleeve portions of the elements are contracted radially inwards so as to exert a stronger gripping or clamping force on the tube and adjacent fin elements also tend to become wedged together by the mutual inter-engagement through their nesting sleeve portions. The sleeve portions are also preferably divided into tongue-like segments, as by axially-extending notches or slots, to enhance their resilient push-fit and gripping characteristics.

In the accompanying drawing,

Figure 1 is a perspective view showing, by way of example, the assembly of a typical heat exchanger finned tube member in accordance with the invention;

Figure 2 is a longitudinal sectional view through the finned tube member of Figure 1;

Figure 3 is a fragmentary detail sectional view on a larger scale showing the inter-engagement of adjacent fin elements on the tube; and

Figure 4 is a front elevational view of a single fin element before assembly.

Referring to the drawing, it will be seen that the heat exchanger finned tube member is made up of a main tube element 10 for conveying a heat exchange fluid and a plurality of separate fin elements 12 assembled in juxtaposed relationship along the length of the tube element 10.

Each fin element 12 comprises a sheet-metal plate portion 14 of circular disc-like form having a central aperture 16 defining the mouth of the leading end of an integral short axial sleeve 18.

The aperture or mouth 16 is slightly oversize with respect to the tube 10 so that the latter will readily enter therein, but towards the opposite trailing end the cross-sectional size of the sleeve 18 decreases so as to be slightly undersize whereby each element 12 is a push fit on the tube 10. As shown more clearly in Figure 3, the aperture or mouth 16 is in fact slightly flared while the sleeve has a somewhat conical or tapering configuration depicted for clarity in a rather exaggerated form.

Also, to enhance its resiliently yieldable characteristics, the sleeve 18 is divided circumferentially into a number of tongue-like segments 22 by V-shaped notches or gaps 24. Each segment terminates in a slightly arcuate rear edge 25 at the trailing end of the sleeve.

The sheet-metal material of the fin elements 12 may be a spring steel but this is not essential and appropriate grades of mild steel for example can be suitable.

The fin elements 12 are assembled on the tube 10 by pushing them on from one end and moving them along until adjacent elements 12 all lie in abutting relationship with one another in which condition the trailing end of each sleeve 18 engages and enters within the aperture or mouth of the next adjacent element as indicated in Figures 2 and 3. In this operation, sufficient axial pressure is applied whereby the tongue-like segments 22 of this trailing end of each sleeve tend to be somewhat flattened and to be forced radially inwards or contracted by the tapering configuration of the sleeve 18 of the next adjacent element so as firmly to grip the tube 10 and establish a relatively large area of close surface contact necessary for efficient thermal conductivity. The slightly arcuate rear edges 25 of the segment 24 may then tend also to bite into the surface of the tube 10 to enhance the grip on the latter. Moreover, adjacent fin elements themselves also tend to become mutually wedged together in this operation.

The sleeve portion 18 of each fin element 12 thus serves to provide a spacer for separating the plate portions 14 forming the fins of adjacent elements by a suitable distance from one another and to provide for locking the elements 12 firmly in position on the tube 10, in good thermal contact therewith, so that the elements will not become loose even with repeated thermal expansion and contraction during use.

If desired, for the endmost fin element 12 whose sleeve portion 18 does not engage with any adjacent element, its sleeve portion may be force fitted with an exterior retaining ring for greater security, as indicated in broken lines at 30 in Figure 3.

The form of construction described is simple but effective and is well adapted for efficient quantity production methods. Thus, in one convenient method of assembly and production, the fin elements 12 may be fed automatically to a jig in which they are located in co-axial alignment at spaced intervals while the heat exchanger tube element 10 is threaded through with a relatively low axial force, and subsequently jaws or other movable pressure members are applied to the elements at opposite ends to exert a greater axial force so as to compress all the fin elements together and cause them to interengage and be clamped to the tube as described above.

It will of course be understood that various modifications can be made within the scope of the invention to the precise structural details described in connection with this exemplary embodiment, and in particular the shape of the fin elements can be altered so that the plate portions forming the fins may, for example, have a rectangular contour. Also, this kind of construction can equally well be adapted to heat exchanger tube elements of non-circular cross-section by providing the fin elements with an aperture and sleeve portion of corresponding non-circular cross-sectional configuration.

The fin elements themselves may be produced from sheet-metal blanks by simple pressing or other conventional sheet-metal working operations.

CLAIMS (Filed 27 April 1982)

1. A heat exchanger comprising a tube element and separately formed fin elements in the form of push-on sheet-metal fittings each having plate portion means providing a fin and an integral generally axially-extending sleeve portion which, when the fin element is assembled on the tube element, in use, receives and embraces the tube element and engages the latter in close thermal contact therewith and exerts a resilient gripping or clamping force that frictionally holds said fin element in position on the tube element, said sleeve portion also providing a spacing means for locating the next adjacent fin element.

2. An exchanger as claimed in claim 1 in which adjacent fin elements are co-operable with one another on the tube element to increase the resilient gripping or clamping force.

3. An exchanger as claimed in claim 1 or claim 2 in which the sleeve portions of the fin elements have a slightly tapering profile so that when assembled on the tube element adjacent fin elements rest together with a trailing end of the sleeve portion of one of the fin elements engaging and projecting into the open mouth at a leading end of the sleeve portion of an immediately adjacent element.

4. An exchanger as claimed in claim 3 when dependent from claim 2 in which the trailing ends of the sleeve portions are contracted radially inwardly and said sleeve portions are wedged together.

New claims or amendments to claims filed on 18.11.82.

New or amended claims:-

CLAIMS

1. A heat exchanger comprising a tube element and separately formed fin elements in the form of push-on sheet-metal fittings each having plate portion means providing a fin and an integral generally axially-extending sleeve portion which, when the fin element is assembled on the tube element, in use, receives and and embraces the tube element and engages the latter in close thermal contact therewith and exerts itself a resilient gripping or clamping force that frictionally holds said fin element in position on the tube element, said sleeve portion also providing a spacing means for locating the next adjacent fin element, and in which adjacent fin elements are co-operable with one another on the tube element to increase the resilient gripping or clamping force, and in which the sleeve portions of the fin elements taper in the axial direction away from the plate portion means so that when assembled on the tube element adjacent fin elements rest together with the trailing end of the sleeve portion of one of the fin elements engaging a tapered part of the sleeve portion and projecting into the open mouth at the leading end of the sleeve portion of an immediately adjacent element, the open mouth being wider than the tube element and the width of the trailing end of the sleeve portion of one of the fin elements engaging a tapered part of the sleeve portion and projecting into the open mouth at the leading end of the sleeve portion of an immediately adjacent element, the open mouth being wider than the tube element and the width of the trailing end of the sleeve portion before assembly being less than the width of the tube element, in which the trailing ends of the sleeve portions are contracted radially inwardly and said sleeve portions are wedged together axially by mutual interengagement to thereby lock adjacent fin elements together, and in which the trailing ends of the sleeve portions have arcuate rear edges which bite into the tube element, and in which each sleeve portion is divided into tongue-like segments to enhance resilient push-fit and gripping characteristics.

2. An exchanger as claimed in claim 1 in which a retaining ring is provided which, in use, locks the sleeve portion of an endmost fin element to the tube element.

3. An exchanger as claimed in claim 1 or claim 2 in which the fin elements are generally disc-shaped.

4. An exchanger as claimed in claim 1 in which the fin elements are substantially as herein described with reference to the accompanying drawings.

5. A method of making a heat exchanger, said method comprising:

a) Separately forming fin elements in the form of push-on sheet-metal fittings each having a plate portion providing at least one fin and an integral

generally axially-extending sleeve portion of slightly tapered profile;

b) locating the fin elements onto a tube element so that the sleeve portions receive and embrace the tube element and engage the latter in close thermal contact therewith and exert themselves a resilient gripping or clamping force that frictionally holds said fin elements on the tube element, and

c) positioning the fin elements along the tube element with said sleeve portions spacing adjacent fin elements from one another so that said elements lie in abutting relationship with one another and so that trailing ends of the sleeve portions engage and project into leading mouths of immediately adjacent sleeve portions under an axial compressive force applied after said fin elements have been located on the tube element, and in which adjacent fin elements are mutually wedged together and locked in position on the tube element, and in which the fin elements are fed automatically to a jig in which they are located in co-axial alignment at spaced intervals while the tube element is threaded therethrough, and subsequently applying pressure to opposite endmost fin elements to compress the fin elements together in mutual interengagement and to the tube element.

6. A method as claimed in claim 5 in which the fin elements are formed from sheet-metal blanks by a pressing operation.

7. A method as claimed in claim 5 or 6 comprising introducing an exterior retaining ring onto a sleeve of an endmost fin element.

8. A method as claimed in claim 5 and substantially as herein described with reference to the accompanying drawings.

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